

polymerize a little.

The reaction temperature is preferably 30-100°C. The temperature lower than 30°C slows down the reaction to need a long time for completing. The temperature higher than 100°C is undesirable because it causes many side reactions. After the reaction ends, epihalohydrin and dimethyl sulfoxide in surplus are distilled out under reduced pressure. If necessary, the produced resin can be dissolved in an organic solvent and then be submitted to the dehydrohalogenation with an alkali metal hydroxide.

The ethylenically unsaturated group-containing monocarboxylic acid compound (f) to use for preparing the unsaturated group-containing polycarboxylic resin (B) includes (meth)acrylic acid and an acrylic acid dimmer. (Meth)acrylic acid is preferable.

To prepare the above unsaturated group-containing polycarboxylic resin (B), it is preferable that the epoxy resin (e) is reacted with the ethylenically unsaturated group-containing monocarboxylic acid compound (f) to obtain an epoxy (meth)acrylate compound, which is then reacted with a polybasic acid anhydride(b-2).

The epoxy resin (e) is preferably reacted with the ethylenically unsaturated group-containing monocarboxylic acid compound (f) in such a way that the quantity of the carboxyl

group of the component (f) is 0.3-1.2 equivalent especially preferably 0.9-1.05 equivalent per 1 equivalent of epoxy group of the epoxy resin.

The reactive diluent (C-1) and/or the non-reactive diluent (C-2) as described below may be used while the reaction lasts or after it ends.

The non-reactive diluent (C-2) includes an aromatic hydrocarbon such as toluene and xylene; an ester such as ethyl acetate and butyl acetate; an ether such as 1,4-dioxane and tetrahydrofuran; a ketone such as methyl ethyl ketone and methyl isobutyl ketone; a glycol derivative such as butyl cellosolve acetate, carbitol acetate, diethylene glycol dimethyl ether and propylene glycol monomethyl ether acetate; an alicyclic hydrocarbon such as cyclohexanone and cyclohexanol; and a petroleum solvent such as petroleum ether and petroleum naphtha. These may be used alone or in the combination of two or more.

For accelerating the reaction, a catalyst is preferably used. The catalyst includes triethylamine, benzylmethylamine, methyl triethylammonium chloride, triphenyl stibine, and triphenyl phosphine. The catalyst is preferably used in an amount of 0.1-10% by weight, especially preferably of 0.3-5% by weight relative to a mixture of the reacting materials.

For preventing the ethylenically unsaturated groups from polymerizing during the reaction, a polymerization inhibitor is preferably used. The polymerization inhibitor

includes methoquinone, hydroquinone, methyl hydroquinone, and phenothiazine. The inhibitor is preferably used in an amount of 0.01-1% by weight, especially preferably of 0.05-0.5% by weight relative to a mixture of the reacting materials. The reaction temperature is 60-150 °C , especially preferably 80-120°C. The reaction time is preferably 5-60 hours.

The epoxy (meth)acrylate compound as obtained above can be reacted with the polybasic acid anhydride (b-2) to obtain the above unsaturated group-containing polycarboxylic acid resin (B).

For the polybasic acid anhydride (b-2) to use for the reaction, those as described in the paragraph of a polybasic acid anhydride (b-1) having at least two acid anhydride groups can be used. However, a polybasic acid anhydride having one acid anhydride group is preferably used. For the polybasic acid anhydride, the acid anhydride of a C1-C20, preferably C2-C7 aliphatic hydrocarbon (saturated, unsaturated, or cyclic) substituted with two carboxyl groups or the acid anhydride of a C6-C10 aromatic dicarboxylic acid is preferable. The acid anhydride of a C2-C4 aliphatic hydrocarbon is more preferable.

The preferable polybasic acid anhydride (b-2) includes succinic anhydride, maleic anhydride, itaconic anhydride, tetrahydrophthalic anhydride, hexahydrophthalic anhydride, 3-methyl-tetrahydrophthalic anhydride, and